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大山口低等四足类动物群中的两栖类
——甘肃玉门晚二叠世脊椎动物群系列报道之五[1)]

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摘要　首次记述了大山口低等四足类动物群中的两栖类。其中走廊泰齿螈(*Ingentidens corridoricus* gen. et sp. nov.)和祁连兄弟迟滞螈(*Phratochronis qilianensis* gen. et sp. nov.)为石炭蜥目迟滞鳄科(Anthracosauria, Chroniosuchidae)的新成员。前者个体较大,具为数众多的犬齿状齿和齿骨表面的齿骨沟,冠状骨无齿,下颌表面纹饰蜂窝型;后者个体较小,侧生型齿,上颌仅有 3 个粗大的犬齿状齿。石油似卡玛螈(*Anakamacops petrolicus* gen. et sp. nov.)是中国二叠纪离片椎目 (Temnospondyli) 的唯一代表。头骨中等大小,吻部扁平,前颌孔被前颌骨和锄骨包围,内鼻孔长大,锄骨表面粗糙,内鼻孔内缘光滑。这 3 个新属种的发现丰富了大山口动物群的组成,进一步证实了它与俄罗斯晚二叠世脊椎动物群的密切关系。

关键词　甘肃玉门,晚二叠世,石炭蜥目,离片椎目

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玉门大山口晚二叠世低等四足类动物群以原始的兽孔类为主,它们不仅种类较多——至今已有 3 属 3 种被报道(程政武等,1996,1997;李锦玲等,1997),而且化石数量巨大,如果以完整或不完整的牙床统计,可达数十个个体。而两栖类的材料则较为稀少。本文所记述的材料都不完整,但从头骨及下颌外表面的凹坑纹饰、排列整齐的边缘牙齿、上颌骨腭面大的犬齿等特征可以确定它们属‘迷齿两栖类’。研究表明它们可分别归入石炭蜥目(Anthracosauria)的迟滞鳄科(Chroniosuchidae),和离片椎目(Temnospondyli)的双顶螈科(Dissorophidae)。

按照传统的分类方法古生代的两栖类被分为迷齿亚纲(Labyrinthodontia)和壳椎亚纲(Lepospondyli)。早先认为迷齿类是最原始的两栖类,是自扇骨鱼祖先(rhipidistians)直接发展进化而来的一个单系类群。它继承了扇骨鱼的原始特征:齿质具迷路构造;腭面的边缘骨片(上颌骨和外翼骨)具大的犬齿和与之相伴的置换凹坑;椎体是由超过一个部分组成。迷齿类最重要的衍生特征是由几个单元组成的环椎—枢椎组合呈环状,与枕髁相连。迷齿类是由离片椎类和石炭蜥类组成。这一传统的分类方法在近年受到置疑。分支分类

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学的分析表明不存在单系的迷齿两栖类和壳椎类(见 Benton,1997 P.98 的综合图解),原属壳椎类的*Microsauria* 是单系的离片椎类最近的姐妹群。它们与 Colosteidae 及Nectridea 一道与单系的石炭蜥类为姐妹群关系。

离片椎类和石炭蜥类作为最原始陆生四足类的代表,在生物进化上占有非常重要的地位。二叠纪时它们繁盛于北美、欧洲、印度、南非和澳大利亚等地,但中国尚未见二叠纪离片椎类的报道,只有新疆芦草沟组的 *Urumuqia liudaowanensis*(张法奎等,1984)和河南济源上石盒子组的 *Bystrowiana sinica*(杨钟健,1979)是石炭蜥类在中国的代表。此次这两类动物在甘肃玉门的发现大大地丰富了大山口动物群的组成,为与华北、新疆、俄罗斯及南非同时代脊椎动物群的对比提供了新的依据。

石炭蜥目 Anthracosauria

迟滞鳄亚目 Chroniosuchia

迟滞鳄科 Chroniosuchidae

泰齿螈(新属) *Ingentidens* gen.nov.

词源 *Ingenti-* 拉丁词"极大",*-dens* 拉丁词"齿"。大的古称为"泰",故中文名为泰齿螈。

特征 个体中等大小,头长超过 300mm;边缘齿为数众多(约 45 个),下颌具多个大的犬齿状齿(12 个),其后的牙齿自前向后逐渐减小;下颌表面纹饰蜂窝型;齿骨具平行于上缘的齿骨沟(sulcus detalis);冠状骨无齿;麦克尔氏孔(Meckelian fenestra)大。

走廊泰齿螈(新属新种)*Ingentidens corridoricus* gen. et sp.nov.

(图 1; 图版 I)

词源 corridor- 地名,示化石产于中国著名的河西走廊。

正模 一后端稍缺损的右下颌支(IGCAGS V 363)。

产地及层位 甘肃玉门大山口,上二叠统西大沟组。

特征 同属的特征。

标本描述 右下颌支基本完整,只有后端部分骨片破损。下颌前端的缝合部平面与下颌侧面间夹角小于 90°,推测是埋藏时受挤压,由纵向扭曲造成的。化石表面有些长而深的沟,估计是埋藏时骨片断裂所致,它们在一定程度上混淆了骨片之间的界线。下颌支窄而长(测量数据见表 1),前低后高,最大高度位于冠状骨处。外侧视下颌支下缘呈轻微

表1 右下颌支测量

Table 1 Measurements of the right ramus of lower jaw (mm)

保存长度 (the preserved length)	310
最大高度(the maximum height)	64
前端高度(the height of anterior end)	12
缝合部长(the length of symphysial region)	25
麦克尔氏孔高(the height of Meckelian fenestra)	17
麦克尔氏孔长(the length of Meckelian fenestra)	62

的波状，顶视中、后部平直，前部（约占下颌长度的 1/4）略向外侧扩展。外侧面具清晰的纹饰。

下颌缝合部短，上表面光滑，无齿亦无凹坑。下颌缝合线与下颌支延伸方向的夹角 20°。齿骨窄长条形，长度超过整个下颌长度的 2/3，达228mm。最大高度位于其中后部，达 20mm。齿骨顶面牙齿着生部前宽后窄。齿骨与隅骨、上隅骨、后夹板骨的界线清晰。齿骨外侧面前端具细小而稀疏的凹坑纹饰，中部及后部有更为稀疏而不规则的嵴。在齿骨的上部有一平行于上缘的沟，自其长度的前 2/5 处向后延伸，Romer(1947) 将见于早三叠世 *Benthosuchus*和 *Parotosaurus* 等两栖类中的类似构造称为 sulcus dentalis。在此标本上，齿骨之后此沟沿上隅骨的上缘继续后延。

上隅骨为一中等大小的骨片，后端稍有断失。它的四周为宽窄深浅不等的沟，对比 *Chroniosaurus dongusensis* 和 *Chroniosuchus parasoxus* 来看（见 Ivachnenko and Tverdochlebova, 1980 图 1，2），它们似乎标志着与冠状骨、隅骨、齿骨的界线。上隅骨的外表面具不规则的蜂窝状纹饰，它们比齿骨表面的纹饰发育，但不如隅骨的分布规则，这证明了由沟所确定的骨片间界线不会有大的出入。隅骨是一块大而长的骨片。它的前端变尖，插

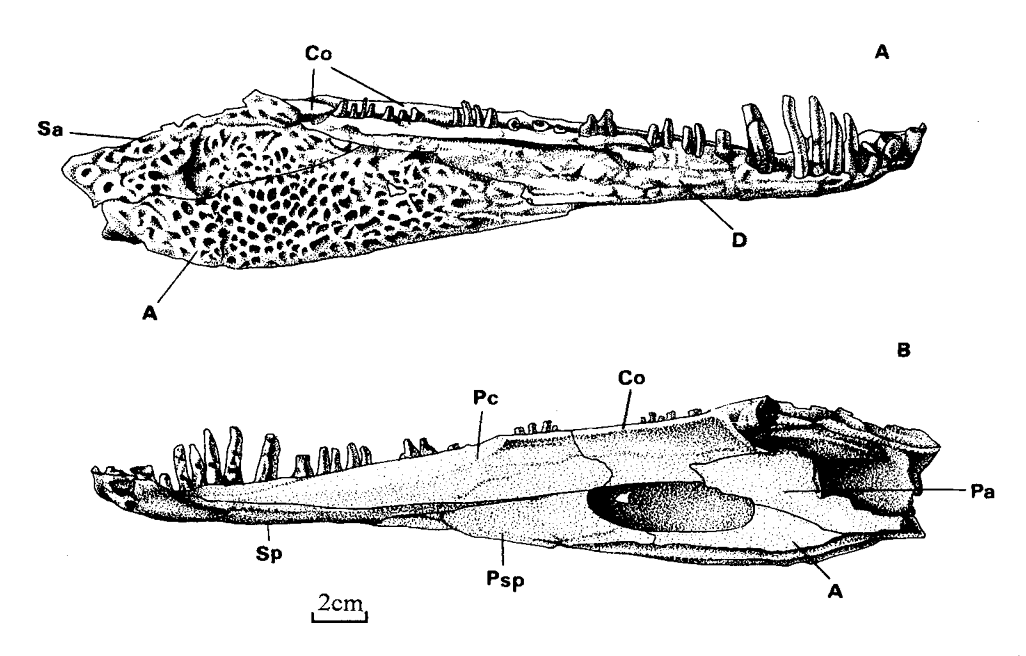


图 1 走廊泰齿螈正模（IGCAGS V 363） A. 唇侧视； B. 舌侧视

Fig. 1 *Ingentidens corridoricus* gen. et sp. nov. (IGCAGS V 363), A. labial B. lingual view

简字说明(Abbreviation): A. 隅骨(Angular); Co. 冠状骨(Coronoid)； D. 齿骨(Dentary)； Pa. 前关节骨(Prearticular)； Pc. 前喙状骨(Precoronoid); Psp. 后夹板骨(Postsplenial); Sa. 上隅骨(Surangular) Sp. 夹板骨(Splenial)

入齿骨和后夹板骨之间。它的腹缘后部上扬，与下颌底边形成 150°的角，以此角顶为中心隅骨表面的凹坑纹饰呈放射状分布。舌面隅骨组成了麦克尔氏孔的腹后缘，它的前端与后夹板骨，后端与前关节骨相接，在接触处隅骨被这两个骨片所覆压。

冠状骨保存基本完整，但不同于 *Chroniosaurus, Chronisuchus* 具前、中、后三块冠状骨，而泰齿螈上只可分辨出一前一后的两个硕大骨片。冠状骨贴于齿骨的内侧，埋藏时受挤压向上错动，其上缘高出齿骨顶面，后端甚至高过齿列后部的牙齿。骨片表面光滑，无牙齿着生。前冠状骨前端尖突状，向后逐渐加宽，后部贴于后冠状骨的外侧，二者间有很长一段距离的重叠。后冠状骨的上缘形成一窄嵴，由于骨片表面的纵向内凹，该嵴稍向舌侧移动。冠状骨在齿列之后形成下颌的最高点，然后向后下方延伸。外侧视后冠状骨与上隅骨和齿骨相接，外表面亦有稀疏的纹饰。

夹板骨和后夹板骨之间及与周边骨片的界线不易确定，这两块骨片占据了下颌前部的腹缘。外侧面具稀疏的纹饰，内面光滑。夹板骨的前端未保存，但齿骨腹面保存了与夹板骨结合的凹面，此面上可见一窄沟自后部通出，直达缝合部。后夹板骨组成麦克尔氏孔前部的边缘。关节骨和前关节骨破损。后者保存的部分与隅骨的舌面贴接。麦克尔氏孔被夹板骨、隅骨和前关节骨所包围。比起 *Chroniosaurus* 和 *Chroniosuchus* 来泰齿螈的麦克尔氏孔要大得多。收肌凹的形态不完整，它开口向内上方。

右下颌支保存了 30 个不完整和几乎完整的牙齿。齿间距大小不等。从几个保存完好的连续牙齿来看，正常状态下的牙齿排列紧密，彼此间只有很小的间隔。如果较大的间隔都有牙齿着生的话，推测完整齿列的齿数可达 45 左右。最前端的牙齿较小，向后逐渐增大。从保存的第 3 齿（相当于推测完整齿列的第 5 齿）至保存的第 10 齿（相当于推测完整齿列的第 16 齿）为硕大的犬齿状齿。向后牙齿又逐渐变小，直至齿列终结。保存的第 8 齿（相当于推测完整齿列的第 12 齿）最大，齿冠高 25mm，齿基部横宽 12mm；而齿列末端完整的倒数第 3 齿齿冠仅高 6mm，齿基部横宽 4mm。牙齿的基部唇–舌向宽，前–后向窄。除了前端缝合部的几个牙齿外，余者的齿基部与齿骨顶面的宽度相等。而齿冠上部的横切面为唇–舌向稍扁的椭圆形，没有前后嵴。齿列前部的牙齿弯曲向内，这在几个保存较好的犬齿状齿上表现得最为明显。而后部的小齿为直的扁锥状。

比较与讨论　由于两栖类各种属特征主要记述的是头骨各骨片的关系，在头骨缺失，只从一下颌支来确定种属的情况下，一般来说要作较大范围的对比。但采自大山口的化石中包括不少动物背部的骨板，它们自身之间虽然在形态与顶面纹饰结构上有所差异，但总体上都与二叠毕氏螈（*Bystrowiana permia*）的骨板相似（Vjushckov, 1957），这一事实标示着此类动物在该化石点的存在。Ivachnenko 和 Tverdochlebova（1980）认为毕氏螈属毕氏螈科（Bystrowianidae），迟滞鳄亚目。迟滞鳄是一类生活于晚二叠世，以陆生习性为主的两栖类动物。它们大小不等，头长 200～550mm；巨大的眶前孔从鼻孔一直延至眼眶；内鼻孔长且宽；耳裂往往是侧向的；身体背部有一列与其下脊椎神经棘相接的具纹饰的骨板。这类动物最初只发现于俄罗斯上二叠统鞑靼阶（Tatarian），其后地理分布扩展至中国的河南济源（杨钟健，1979），地史分布扩展到三叠纪的 5 个层位，最迟达中三叠世的拉丁尼克期（Ladinian）（见 Novikov and Shishkin, 1995）。Chroniosuchia 中包括两科，Chroniosuchidae 和 Bystrowianidae。Golubev（1998a, b）对它们，特别是前者进行了较为详细的讨论和总结。这两科在眼眶方向、眶前孔和眶后孔的存在或缺失、鳞骨与眶后骨是否相接、翼骨凸缘的位置、背部骨板和间椎体的构造等项特征上互相区别。Chroniosuchidae 的成员个体较大，头长 250～550mm；Bystrowianidae 的成员头长仅达 200mm。泰齿螈的头骨长度与

Chroniosuchidae 相符。据 Golubev (1998a, b), Chroniosuchidae 中包括 4 属, *Chroniosaurus*、*Chroniosuchus*、*Jarilinus* 和 *Uralerpeton*。

泰齿螈的下颌支与 *Chroniosaurus*、*Chroniosuchus* 保存的下颌支在外形上十分相似。它们的前部都较低,后部升高;上缘、下缘都较为平直;下颌缝合线短,缝合部平面上不具犬齿和与之相伴的凹坑。但泰齿螈的另一些特征使它有别于俄罗斯同时代的属:1)泰齿螈齿骨上的 sulcus dentalis 未见于 *Chroniosaurus* 和 *Chroniosuchus*。2)泰齿螈的冠状骨表面无齿,而 *Chroniosaurus* 和 *Chroniosuchus* 的冠状骨象许多原始的两栖类一样具众多细小的牙齿。3)泰齿螈下颌第 5~16 齿非常大,这一现象极为特殊,它不仅没有出现在 4 个俄罗斯二叠纪的属中,也几乎未见于所有的化石两栖类。4)泰齿螈的麦克尔氏孔明显地大于 *Chroniosaurus* 和 *Chroniosuchus* 的麦克尔氏孔。基于这些特征,这一两栖类的下颌支代表一单独的属是没有问题的。

兄弟迟滞螈(新属) *Phratochronis* gen.nov.

词源 *Phrat-* 希腊词"同族的兄弟", *Chroni* 希腊词"迟的", *Phratochronis* 意为它是迟滞鳄类 (*Chroniosaurus, Chroniosuchus*) 的同族兄弟。

特征 个体较小的迟滞鳄类(上颌齿列约长 115mm, 估计头长 170mm), 以具较粗壮的犬齿状齿有别于俄罗斯的迟滞鳄类;而以明显的侧生型齿,较少的犬齿状齿(3 个),和较为一致的牙齿形态及大小区别于走廊泰齿螈。

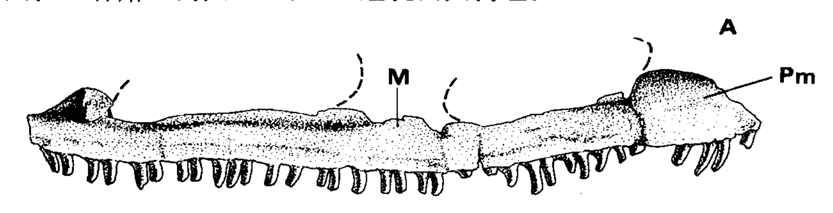
祁连兄弟迟滞螈(新属新种) *Phratochronis qilianensis* gen.et sp.nov.

(图 2; 图版 II, A,B)

词源 qilian- 山名,示化石产于祁连山北坡。

正模 保存不完整的右前颌骨和右上颌骨 (IGCAGS V 364)。

产地和层位 甘肃玉门大山口,上二叠统西大沟组。



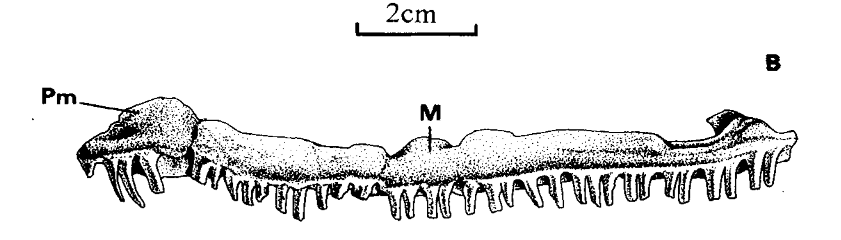


图 2 祁连兄弟迟滞螈(新属新种)正模 (IGCAGS V 364) A. 唇侧视; B. 舌侧视

Fig.2 *Phratochronis qilianensis* gen. et sp. nov. (IGCAGS V 364) A. labial B. lingual view

简字说明 (Abbreviation): M. 上颌骨 (Maxilla); Pm. 前颌骨 (Premaxilla)

特征　同属的特征。

标本描述　保存的右前颌骨前端缺失了很小部分，后端与上颌骨的界线正好位于化石的断裂处。它的腹缘内侧呈弧形，推测为前颌骨孔的边缘。前颌骨保存了5个牙齿，其间有3个较大的空隙，可能是由牙齿脱落造成的。保存的第2、3齿完整，齿冠为弯曲向后的锥状。保存的第4、5齿缺失了齿冠上部，其基部比起其余的前颌骨齿、上颌骨齿要粗大许多，推测为犬齿状齿。这两个齿基部间有一大的齿隙，将它计算在内犬齿数为3。

上颌骨纤细，后端稍有缺失，但上颌齿列可能是完整的。上颌骨中部有保存不完整的背突，背突前后低的上颌骨背缘标示着前、后眶前孔的存在。外表面未见凹坑纹饰，但有纵向的深沟。上颌骨齿基部与上颌骨腹缘等宽，外侧缘比内侧缘更延伸向下，牙齿呈明显的侧生型。上颌骨上总计保存了29个牙齿和15个齿虚位。牙齿大小几近相等、形态相似，稍许的差异无规律可循。

比较与讨论　标本保存不好，但上颌骨背缘的结构显示该动物的头骨具2个眶前孔。将它归入迟滞鳄科，而不是毕氏螈科是没有疑问的。与俄罗斯同时代的*Chroniosaurus*、*Chroniosuchus*和*Bystrowiana*比起来，由于具有明显的犬齿状齿，这一前颌骨和上颌骨显然更类似于前述的走廊泰齿螈。二者之间的区别在于：1)它们的个体大小有较大的差异，走廊泰齿螈头长大于310mm，而从保存115mm的前颌骨及上颌骨推测兄弟迟滞螈的头长仅有170mm左右。2)走廊泰齿螈有大约12个硕大的犬齿状齿，而祁连兄弟迟滞螈仅有3个犬齿状齿；前者犬齿后齿自前向后由大变小明显，而后者的上颌骨齿大小几近相等。3)祁连兄弟迟滞螈的牙齿为侧生型。

离片锥目　Temnospondyli

双顶螈科　Dissorophidae

似卡玛螈（新属）　*Anakamacops*　gen.nov.

词源　*Ana-* 希腊词，取其"相似"含义，示这一新属与卡玛螈（*Kamacops*）相似。

特征　头骨中等大小，吻部扁平；前颌孔被前颌骨和锄骨所包围。内鼻孔长大；锄骨表面粗糙，但无密集的粒状小齿；内鼻孔内缘光滑，不具成列的小齿。

石油似卡玛螈（新属新种）*Anakamacops petrolicus* gen.et sp.nov.

（图3；图版 II，C～E）

词源　Petrol- 意指化石产自"石油城"——玉门。

正模　一头骨的左侧前部（IGCAGS V 365）。

产地及层位　甘肃玉门大山口，上二叠统西大沟组。

特征　同属的特征。

标本描述　化石仅保存了头骨前部的一小部分，背面包括左侧的前颌骨、上颌骨、泪骨和鼻骨，腭面可见前颌骨、上颌骨和锄骨。保存长度7cm，后端保存的最大宽度5cm（此处头骨宽10cm）。化石虽不够完整，但它所显示出的特征明显地有别于其他两栖类的属。化石的背腹向扁平，最大厚度（位于外鼻孔内缘处）仅1.5cm。在化石所保存的长度内未见后部升高的现象，说明这一动物具扁平的眶前区。背部各骨片具清晰的表面纹饰，它们由

形态不规则的凹坑和嵴组成。外鼻孔大，椭圆形，由于内边缘高于外边缘，鼻孔在面向上方的同时面向前外侧方。

左前颌骨是这些化石材料中唯一保存完整的骨片。前颌骨的外缘呈圆弧状，自吻部的最前端向后方延伸，它通过外鼻孔的整个长度，达外鼻孔后的相当一段距离。与其他两栖类的前颌骨相比，这是一块相当大的骨片。前颌骨在靠近头骨的中线部位以一较为平直的横向骨缝与鼻骨相接。自外鼻孔下缘的前 1/3 处向后，上颌骨贴接在前颌骨的侧后突上，它们相接的骨缝几乎达前颌骨长度之半。上颌骨的前端呈尖突状，伸入外鼻孔之内，构成其下缘的主要部分。上颌骨、鼻骨、泪骨的后端都不完整，后两个骨块的前端也都伸达外鼻孔，它们构成外鼻孔稍微升高的内缘。

腹面前部沿中线具椭圆形的前颌孔，孔长 1.5cm，宽 0.8cm，它被前颌骨和锄骨包围。腹面外侧方具大的长形内鼻孔，内鼻孔不完全长度 5cm，最大宽度 1.2cm。前颌骨在腹面的形状与背视一致，左右前颌骨联合刚好成一弓形，它沿头骨的边缘向后延伸直达内鼻孔的外侧。上颌骨则只在内鼻孔的外侧有很窄的出露。这两个骨块上具一列边缘齿。牙齿尖锥状，横宽的齿基部表面具放射状纵纹，齿尖弯曲向内。前颌骨保存了 7 齿，上颌骨保存了 3 齿。除第 2、第 3 前颌骨齿紧密相连外，其余各齿间都有较大的齿隙，这些部位未见到牙齿脱落的痕迹，在这些齿间隙是否有牙齿着生很难判定。锄骨占据了腹面的大部分面积，它的表面粗糙，但尚无法确认是由密布的小齿造成的。锄骨的前部，在内鼻孔的前内侧可见一粗大的犬齿及与之相伴的置换凹坑。锄骨组成内鼻孔的内缘，其上不具成列的小齿。

比较与讨论 这一产自上二叠统下部层位不完整的两栖类化石材料，所能提供的信

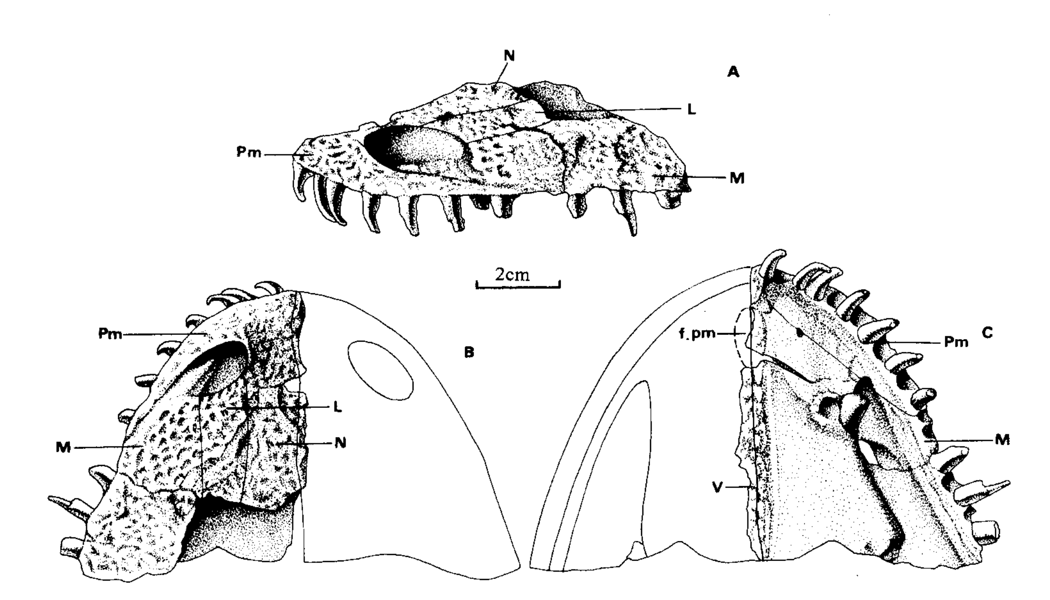


图 3 石油似卡玛螈(新属新种)正模(IGCAGS V 365)A. 左侧视；B. 顶视；C. 腹视

Fig.3 *Anakamacops petrolicus* gen. et sp. nov. (IGCAGS V 365) A. left lateral B. dorsal C. ventral view 简字说明(Abbreviation): f.pm 前颌孔(foramen premaxilla); L. 泪骨(Lacrimal); M. 上颌骨(Maxilla); N. 鼻骨(Nasal); Pm. 前颌骨(Premaxilla); V. 锄骨(Vomer)

息有限。南非的始二齿兽组合带(*Eodycinodon* Assemblage Zone)目前尚无两栖类被发现(Rubidge, 1995)。产自南非晚二叠世貘头兽组合带(*Tapinocephalus* Assemblage Zone)及其以上层位的 *Rhinesuchus*, 由于有小的内鼻孔和多对锄骨上的牙齿而与石油似卡玛螈有明显差异。石油似卡玛螈也不同于俄罗期Ⅰ、Ⅱ带创始螈超科(Archegosauridea)的 *Platyops*、*Collidosuchus* 和 *Melosaurus*。 *Platyops* 具长的吻部和扩展的吻端(Konjukova, 1955a); *Collidosuchus* 具背面的前颌骨突起(eminentia premaxillaris), 腹面的中央结节(tuberculum subostrum medium)和成对的前颌骨孔, 外鼻孔位置相对靠后(Gubin, 1986); 而 *Melosaurus* 的头骨虽然扁平, 但它的泪骨不伸达外鼻孔, 腹面具成对的前颌骨孔和较小的内鼻孔(Konjukova, 1955b)。

与石油似卡玛螈最为相似的是俄罗斯上二叠统上卡赞亚带的 *Kamacops* (Gubin, 1980)。后者的头骨前部亦较为扁平, 椭圆形的外鼻孔位置靠近吻端, 腹面具中央的前颌骨孔和两侧长大的内鼻孔。似卡玛螈与 *Kamacops* 的大小亦非常接近(吻端—内鼻孔后部为 7cm。*Kamacops* 属于 Dissorophidae 科, 该科的成员自中石炭世—早二叠世繁盛于北美, 有十余个属被报道。从老到新个体逐渐加大, 在晚期的属中棒骨和方骨连接, 使原来向后方开口的耳裂关闭, 形成一特殊的大孔。头骨高度加大, 使该孔和眼眶几乎呈垂直状分布, 这是典型陆生动物的标志(Gubin, 1980)。这类动物在石炭纪末期—二叠纪早期传播至西欧大陆, 晚二叠世时出现于俄罗斯的前乌拉尔地区。

俄罗斯最早被报道的dissorophid 属是 *Zygosaurus lucius* Eichwald, 1848。该属正模为一保存不完整的头骨, 头骨相当高, 椭圆形, 眶前部窄, 颞部加宽(见 Rozhdestvenskii and Tatarinov, 1964)。由于头前部的骨片未保存, 与石油似卡玛螈的直接对比是困难的。目前能得出的唯一结论是这具较高头骨的两栖类适于陆地生活, 而石油似卡玛螈的扁平的吻部表明它更象是营水生生活。*Iratusaurus vorax* 是俄罗斯Ⅱ带的第 3 个 dissorophid 的属。它的正模仅保存了头骨的右后部(Gubin, 1980), 与石油似卡玛螈无法直接比较。甘肃玉门大山口的材料与 *Kamacops* 相似, 但它所具有的一些特征妨碍将其归入这一俄罗斯的属。玉门材料的前颌骨腹面为弯曲的长条形, 前颌骨孔位于前颌骨和锄骨的界线上, 且大部分被锄骨包围; 而 *Kamacops* 的前颌骨在腹面有较大的向后延伸, 它整个包围了前颌骨孔。玉门材料的锄骨表面不够光滑, 但这与 *Kamacops* 的锄骨表面所具密集的粒状小齿还不完全相同; 玉门材料内鼻孔的内缘上无齿, 而 *Kamacops* 内鼻孔的内缘上具一列细小的牙齿。这些特征似乎表明玉门材料可以代表 Dissorophidae 中的一个新属。

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NEW ANTHRACOSAUR AND TEMNOSPONDYL AMPHIBIANS FROM GANSU, CHINA——THE FIFTH REPORT ON LATE PERMIAN DASHANKOU LOWER TETRAPOD FAUNA

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Key words Yumen, Gansu, Late Permian, Chroniosuchidae, Dissorophidae

Summary

Based on materials collected from Dashankou, Yumen, Gansu, 3 new genera and species——*Ingentidens corridoricus, Phratochronis qilianensis* and *Anakamacops petrolicus* belonging to Anthracosauria and Temnospondyli, are described in the present paper. Associated with the amphibians are abundant therapsid and bolosaur, which were described previously (Li and Cheng, 1995, 1997; Cheng and Ji, 1996; Cheng and Li, 1997). The Dashankou fauna is the most diverse and abundant tetrapod fauna so far known from the Permian deposits of China. Most members of the fauna show primitive features of lower tetrapods and are more closely related to those of Upper Permian of Russian.

Anthracosauria

Chroniosuchia

Chroniosuchidae

***Ingentidens corridoricus* gen. et sp. nov.**

(fig. 1; pl. I)

Etymology "*Inget-*" Latin word for large; "*-dens*" Latin for tooth; "*corridor-*" referring to the region of Gansu, the Hexi Corridor where the type specimen was found.

Type A right ramus of lower jaw with its posterior end slightly broken (IGCAGS V 363).

Locality and horizon Dashankou, Yumen. Gansu. Xidagou Formation, Upper Permian.

Diagnosis Medium sized with skull longer than 300mm; numerous marginal teeth (45 in number) including many enlarged caniniform teeth (12 in number) on lower jaw; a sulcus detalis present on dentary; bearing no teeth on coronoid and

precoronoid; meckelian fenestra large.

Description The symphysis region is short and has a smooth dorsal surface bearing neither tooth, nor pits. The surface of the dentery(228mm long and 20mm high) is covered with rare and irregular ridges and pits. A distinct groove being parallel to the upper margin of the jaw and extending from middle part of the dentary to the surangular, is present. A similar groove also exists in some Early Triassic amphibians *Benthosuchus* and *Paratosaurus*, which was called as sulcus dentalis by Romer(1947).

The angular is a large bone with its tapered anterior end interposing between the dentary and postsplenial, and its ventro-posterior end forming an obtuse angle (150°). Its lateral surface is sculptured with pits, grooves and ridges, which range radiatively from the apex of the obtuse angle. On the lingual surface the angular forms the ventro-posterior edge of the fenestra meckelian and contacts the postsplenial anteriorly and the prearticular posteriorly. The surangular is almost completely preserved except its posterior end. The sutures of the surangular with the coronoid, angular and dentary appear to be represented by a groove varying in depth and width. The ornamentation of the surangular is more developed than that of the dentary, but not as regular as that of the angular.

In contrast to three coronoids in *Chroniosaurus* and *Chronisuchus,* only two bones, coronoid and precoronoid, can be recognized. They displace upwards distinctly, so that its upper margin is higher than the dorsal surface of the dentary, and even than the posterior dentary teeth. The lingual surfaces of the coronoid and precoronoid are smooth without teeth, but the lateral surface of the posterior end of the coronoid forming the apex of the lower jaw is slightly sculptured.

The splenial and postsplenial occupy the lower margin of the jaw, but the sutures of them are indistinguishable. The splenial seems to enter the symphysis and the postsplenial forms the anterior margin of the fenestra meckelian. The fenestra meckelian of *Ingentidens* is larger than that of *Chroniosaurus* and *Chroniosuchus.* The articular is lost, only a small part of the prearticular is preserved lingually to the angular.

Thirty complete or incomplete teeth are preserved on the lower jaw. If the moderately wide spaces between some teeth are considered as position of lost teeth, the total lower dentition may comtain about 45 teeth. They are arranged in the order of position with respect to size and shape as follows; the lst to 4th (corresponding the 2nd preserved) teeth are relatively small, but increasing in size gradually, the 5th to the 16th (corresponding the 3rd to 10th preserved) are extremely large(the largest one , 12th, 25mm high), the 17th to 45th are decreasing in size again (the 43rd only 6mm high). The crowns of teeth are curved lingually in anterior part of the

dentition, especially in those of caniniform teeth, but are flatten-conical shaped in posterior part of the dentition. The bases of the teeth are almost equal in width to the dorsal surface of the dentary.

Comparison and discussion The authors agree with Golubev(1998a, b) to include four genera *Chroniosaurus, Chroniosuchus, Uralerpeton, Jarilinus* from upper Tatarian, Upper Permian of Russian in the family Chroniosuchidae. The new genura is similar to *Chroniosaurus, Chroniosuchus and Jarilinus* in the shape of lower jaw, and the short and smooth dorsal surface of symphysis region, so, it seems to be safe to refer *Ingentidens* in Chroniosuchidae. Many bony dorsal scutes collected together with *Ingentidens* equally indicate the presence of chroniosuchids in Dashankou locality. *Ingentidens* differs from other chroniosuchids in the following respects: 1) A sulcus dentalis is present in the dentary of *Ingentidens,* but absent in *Chroniosaurus, Chroniosuchus* and *Jarilinus.* 2) The coronoids have smooth surfaces in *Ingentidens,* but bear numerous teeth in *Chroniosaurus, Chroniosuchus* and *Jarilinus.* 3) *Ingentidens* has enlarged teeth(5th to 16th) on lower jaw, which do not appear in other chroniosuchids. 4) The fenestra meckelian in *Ingentidens* is larger than that of other chroniosuchids.

Phratochronis qilianensis gen. et sp. nov.

(fig.2; pl.II)

Etymology "*Phrat-*" (Greek), brothers of a clan, "*chroni*" (Greek), late, "*Phratochronis*"——brothers of chroniosuchids. "*qilian-*" a chain of mountains, where the fossil locality is situated.

Type Incomplete right premaxilla and maxilla with almost complete dentition (IGCAGS V 364).

Locality and horizon Dashankou, Yumen, Gansu. Xidagou Formation, Upper Permian.

Diagnosis Comparatively small and slender chroniosuchian(upper dentition 115mm long, estimated skull length 170mm) with pleurodont dentition, 3 enlarged caniniform teeth, and almost equal sized and equal shaped maxillary teeth.

Description The premaxilla has its anterior end lost. Its suture with the maxilla in lateral view coincides with a fissure, and its curved inner ventral margin may indicate the position of fenestra premaxilla. Five teeth are preserved on the premaxilla, and 3 lost teeth appear to be represented by relatively large spaces between the teeth lst and 2nd, 3rd and 4th, 4th and 5th. The preserved 2nd and 3rd teeth are conical – shaped, with slightly posteriorly bent crowns. The preserved 4th and 5th teeth with upper part of crowns lost are distinctly more robust(judging from their bases) than the anterior premaxillary and maxillary teeth.

The maxilla is incomplete with its posterior end and dorsal process broken. The dorsal margins of the maxilla antero- and posto- to the position of dorsal process are smooth, which implies the presence of two anteorbital fenestrae. There are some longitudinal groove, rather than pits and ridges on the lateral surface of the bone. Twenty nine teeth and 15 teeth positions are present. The conical teeth adhere to the labial-ventral margin of the maxilla, which extends more ventrally than the lingual margin. All the maxillary teeth are similar in size and shape.

Comparison and discussion Although the specimen is poorly preserved, its character, the presence of the anteorbital fenestrae supports to include *Phratochronis* in Chroniosuchidae. The new genus is smaller than all other chroniosuchids. It differs from Russian chroniosuchids in having robust teeth, and from *Ingentidens* in pleurodont dentition, less enlarged teeth and maxillary teeth almost equal in shape and size.

Temnospondyli

Dissorophidae

***Anakamacops petrolicus* gen. et sp. nov.**

(fig, 3; pl. II)

Etymology "*Ana-*" (Greek) similar, indicating that the new genus is closely related to genus *Kamacops*. "*petrolic-*" the fossil locality situated in the extent of Yumen, an oil producing city.

Type A broken skull(IGCAGS V 365).

Locality and horizon Dashankou, Yumen, Gansu. Xidagou Formation, Upper Permian.

Diagnosis Medium sized skull with flat snout; fenestra premaxilla surrounded by premaxilla and vomer; choana quite long and relatively narrow; ventral surface of vomer rough, but bearing no small teeth; inner margin of choana no teeth either.

Description The type specimen consists of a left-anterior part of skull (about 70mm long and 50mm wide), including premaxilla, maxilla, lacrimal, nasal and vomer. The maximum height(at the medial edge of the external nares) of the specimen is only 15mm, which implies that the animal has s very flat snout. The dorsal surface of the skull is ornamented with pits and ridges. The external nares is oval and facing dorsal-laterally. The premaxilla extends along the margin of snout posto-laterally, acrossing the whole length of the external nares, and contacts the maxilla with a long suture. The anterior process of the maxilla enters broadly to the lower margin of the external nares. The incompletely preserved lacrimal and nasal participate to the posterior and medial margin of the external nares.

In the ventral view, a depression(15mm long and 8mm wide) surrounded by the

premaxilla and vomer indicates the presence of the fenestra premaxilla. The inner nares with its posterior part lost is quite long and relatively narrow (maximum width 12mm, incomplete length 50mm). The premaxilla is arched with its posto-lateral extension meeting the maxilla lateral to the inner nares. Seven marginal premaxillary teeth are widely spaced except between the 2nd and 3rd. They have slender and sharp-pointed crowns with their bases shallowly fluted. The incomplete maxilla forms the most part of lateral edge of the inner nares, and bears 3 teeth being similar in shape to the premaxillary teeth. The vomer contacts the premaxilla antero-laterally and forms the medial margin of the inner nares. There is no small teeth on the surface of the vomer and along the margin of the inner nares, but a large tusk and a correspondent depression is present near the anterior end of the inner nares.

Comparison and discussion Because of the incompleteness of the type specimen, the new genus has lost many informations characteristic for the family Dissorophidae. But its features——flattened snout region, large oval-shaped external nares near the anterior end of snout, a central situated fenestra premaxilla and large inner nares on both sides, show great similarities to that of *Kamacops,* a dissorophid from Upper Kazania, Upper Permian of Erzovka, Russian (Gubin, 1980). There is no way to compare *Anakamacops* directly with the other two Russian dissorophids, *Zygosaurus* and *Iratosaurus* (Rozhdestvenski and Tatarinov, 1964; Gubin, 1980), because only posterior parts of skull in the last two genera have been preserved. *Anakamacops* is distinguished from *Kamacops* in the following respects: the fenestra premaxilla is surrounded by the premaxilla and mainly by vomer in *Anakamacops,* but entirely by the premaxilla in *Kamacops.* The ventral surface of the vomer is rough in *Anakamacops,* but bears numerous small teeth in *Kamacops.* A row of small teeth on the medial margin of the inner nares is absent in *Anakamacops,* but present in *Kamacops.*

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图版说明 (Explanations of plates)

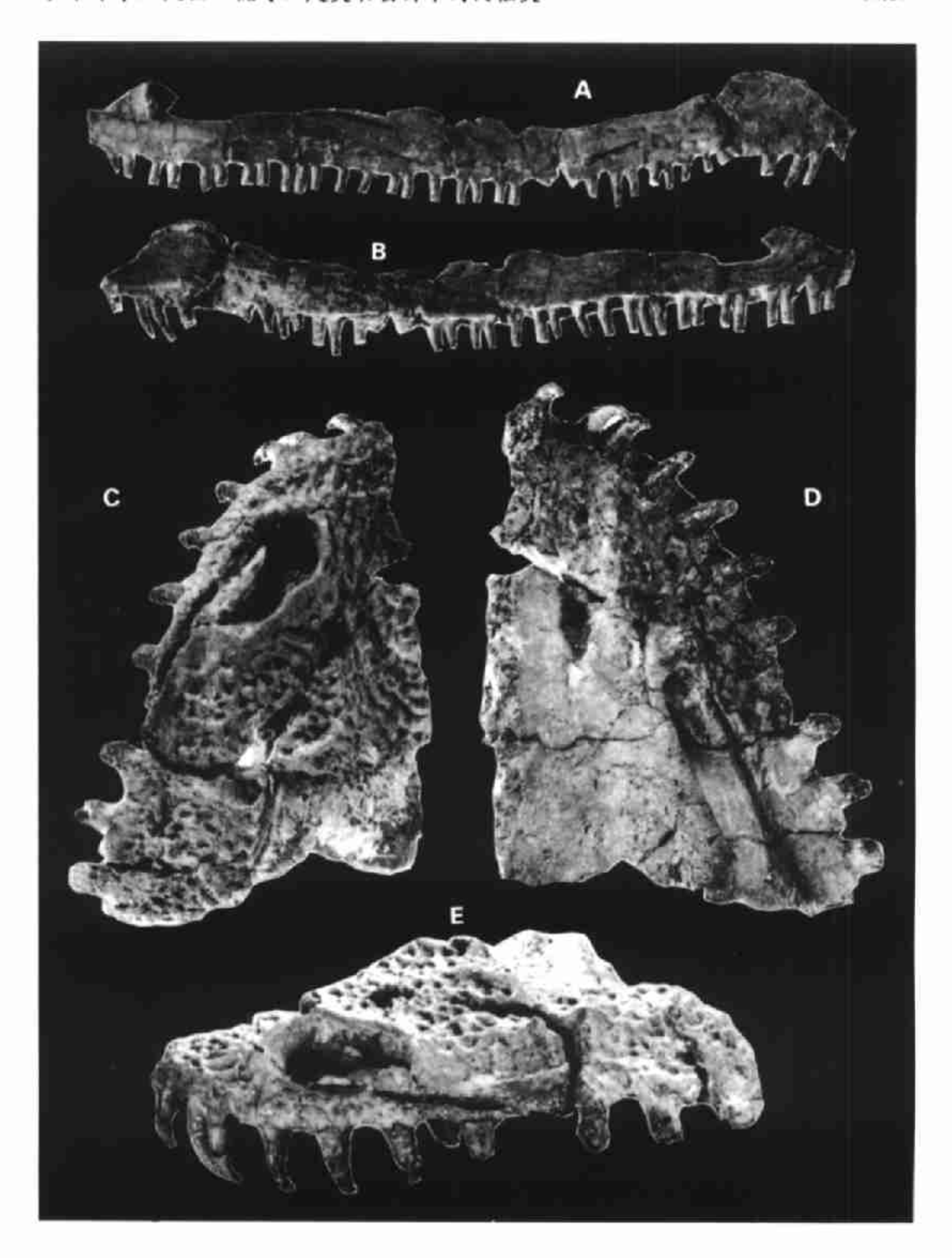
图版 I (Plate I)

走廊泰齿螈 *Ingentidens corridoricus* gen. et sp. nov. 正模 (Holotype, IGCAGS V 363) A. 唇侧视 labial; B. 舌侧视 lingual view ×0.5

图版 II (Plate II)

A～B. 祁连兄弟迟滞螈 *Phratochronis qilianensis* gen. et sp. nov. 正模 (Holotype, IGCAGS V 364) A. 唇侧视 labial; B. 舌侧视 lingual view ×1; C～E. 石油似卡玛螈 *Anakamacops petrolicus* gen. et sp. nov. 正模 (Holotype, IGCAGS V 365) C. 顶视 dorsal; D. 腹视 ventral; E. 左侧视 left lateral view ×1


A
B


A
B
C
D
E